

Quantum Radiation Energy Research Section

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1. Introduction

Coherent-radiation energy with a wide wavelength tunability and a high power is an indispensable tool for exploiting a cutting-edge science. The research in this section aims at generating and application of new quantum-radiation energy. Free-electron laser (FEL) is one of such radiation. We have been developing a mid-infrared FEL, KU-FEL. To extend study field wider wavelength region, a coherent A compact THz source, high Tc undulator for X-ray generation, and Laser Compton Gamma-ray (LCS) for isotope imaging have been carried out. A transdisciplinary research on renewable energy has also been promoted through international collaborations.

2. Free-electron Laser

FEL is a next generation light source because of its wide wavelength tunability where the conventional lasers cannot reach, potential high efficiency, and high peak power. However, the system is usually much larger and the cost is higher than conventional lasers. We are going to overcome these difficulties by exploiting an RF (radio-frequency) gun, a high Tc undulator, etc.

2.1 KU-FEL

The target wavelength of KU-FEL is MIR (Mid infrared) regime, from 5 to 20 μm , with high-power and turnability for basic researches on energy materials. Figure 1 shows a schematic drawing of the KU-FEL system. The KU-FEL consists of a 4.5-cell thermionic RF gun, a 3-m travelling wave accelerator tube, a beam transport system, and a 1.8-m undulator and a 5-m optical resonator. The FEL device now can cover the wavelength range from 3.4 to 28 μm . The maximum macro-pulse energy which can provide is around 40 mJ in a 2- μs macro-pulse at the wavelength of 4.9 μm . The FEL is routinely operated and opened for internal and external users.

Another topic of KU-FEL development is introduction of photo-cathode RF gun, which enables to generate higher peak power and wider tunable range MIR-FEL. Development of a UV-laser system for illuminating photo-cathode has been completed under collaboration with Dr. R. Kuroda, Researcher of AIST. In FY2014, we have achieved FEL lasing with photo-electron beam generated from LaB₆ cathode. In FY2018, the laser system has been upgraded under the Q-LEAP project organized

by MEXT. This upgrade increases the macro-pulse duration of the photocathode operation. Under the photocathode operation, the world highest extraction efficiency of the oscillator-type FEL has been achieved.

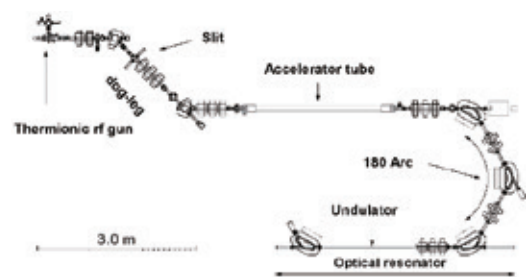


Fig. 1 Schematic drawing of the KU-FEL

2.2 THz Coherent Undulator Radiation Source

A new compact terahertz coherent undulator radiation source (THz-CUR) has been constructed. It consists of a 1.6-cell RF-gun, a solenoid magnet, a magnetic chicane bunch compressor, a triplet quadrupole magnet, a planar undulator, and a laser system for photocathode. Schematic view of the proposed system is shown in Fig 2. In this device, short electron bunches are generated by the photocathode RF gun and the bunch compressor. The electron bunches are injected to the undulator and intense coherent undulator radiation can be generated.

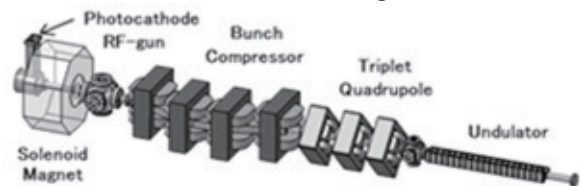


Fig. 2 3D image of THz coherent undulator radiation source.

The 1.6 cell RF gun used for the THz-CUR was replaced with an energy chirping cell attached RF gun for improving its performance under collaboration with Dr. Sakaue, Tokyo University. The gun utilizes a velocity bunching scheme for generating ultra-short electron bunch. A commissioning experiment has been done and the saturation of THz peak power due to space charge effect can be successfully suppressed.

The polarization control method of the THz-CUR has been developed under collaboration with Dr. Kashiwagi, Tohoku University. The polarization state of the THz-

CUR can be easily controlled from linear to left-handed circular and right-handed circular without significant power loss.

2.3 Application of MIR-FEL and THz-CUR

Many application researches of MIR-FEL and THz-CUR has been performed under the Joint Usage/Research Center for Zero Emission Energy Research of our Institute. In JFY2020, 14 external user groups used KU-FEL.

3. Bulk HTSC Staggered Array Undulator

An undulator with strong magnetic field will play an important role in future synchrotron light sources and FELs. We have developing a new undulator which consists of stacked bulk high critical temperature superconductors array and a solenoid magnet. As a next prototype of this type of undulator, we have developed new prototype consists of a new solenoid whose maximum field was 6 T and GM cryocooler. Magnetic performance of bulk MgB_2 sample was measured using a new solenoid and a magnetic field scanner as shown in fig. 3.

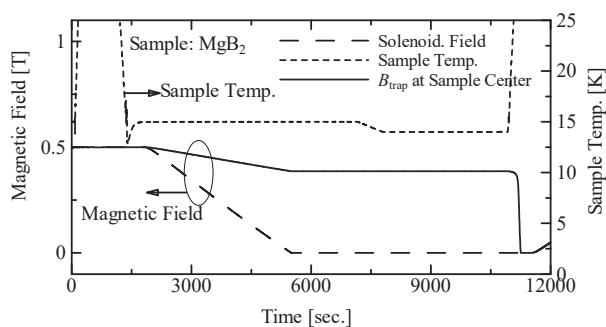


Fig. 3 Trapped magnetic field of MgB_2 sample.

4. Isotope Imaging for Nuclear Security

A Nuclear Resonance Fluorescence (NRF) method is a powerful tool for an isotope selective imaging. In 2020, we tried to obtain a 3D image of the CT target, which consists of two enriched isotope targets, ^{206}Pb (>93.3%) and ^{208}Pb (>97.8%), with an aluminum target holder. The LCS gamma-ray beam with a maximum energy of 5.528 MeV and a $10 \text{ photon} \cdot \text{s}^{-1} \cdot \text{eV}^{-1}$ flux density was developed

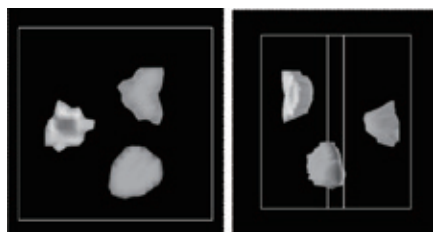


Fig. 4 3D NRF-CT image.

in UVSOR. The NRF transmission technique was employed. The transmission gamma-rays have also been

measured to give a density distribution of the sample target at the same time. After suppressing the non-resonant absorption process, the NRF-CT images, which indicate the distributions of ^{208}Pb , were obtained as shown in Fig. 4.

5. Study on Social Aspect of Renewable Energy

Electrification projects using renewables in rural settings are essential to achieve SDG7. These projects can positively influence several other aspects of community development. Our group investigates the effects of electrification in rural contexts of ASEAN region comparing the process and outcomes of different electrification systems.

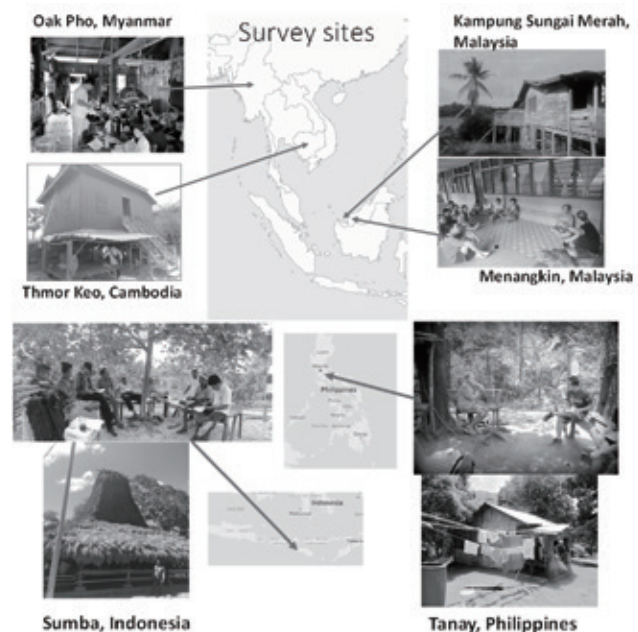


Fig. 5 Case studies since 2016

Our group has conceived a novel method to evaluate the social impact of electrification in SEA using quality of life (QoL) measures. With this approach, we assessed the conditions prior and after electrification in communities in Malaysia, Cambodia, Myanmar, Indonesia and The Philippines (Fig. 5). We also study on the relation between energy services and human well-beings in Japanese and Mexican communities.

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Collaboration Works

大垣英明, University of Malaya (マレーシア), 倉田奨励基金:「Before and After 手法による東南アジアにおける非電化地区への再生可能エネルギー導入の住民生活に与える影響に関する研究」

大垣英明, NSTDA (タイ), JASTIP, WP2

大垣英明, University of Malaya (マレーシア), JASTIP-net

大垣英明, Jordi Cravioto, NSTDA (タイ), JAPAN-ASEAN Science and Technology Innovation Platform, Energy and Environment field

大垣英明, Jordi Cravioto, University of Malaya (マレーシア), Theoretical and Experimental Investigation of Battery Dimensioning for Rural Electrification based on Segmented Quality of Life Progressions of Rural Communities in Malaysia

大垣英明, 森井孝, 片平正人, 野平俊之, モンゴル国立大学, インドネシア大学, フィリピン大学ディリマン校, ベトナム国家大学ハノイ校, ラオス国立大学, 王立ブノンペン大学, アジア新興国産天然資源を由来とする機能性物質創生のための高度分析研究拠点の形成

大垣英明, 分子科学研究所共同利用研究, UVSOR-BL1U からの LCS ガンマ線を用いた NRF 同位体 3D イメージング法の高分解能化

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Financial Support

1. Grant-in-Aid for Scientific Research

大垣英明, 基盤研究(A), 直線偏光ガンマ線のデルブリュック散乱 (分担金)

大垣英明, 基盤研究(B), LCS-NRF による同位体 3D イメージング法の基盤確立

紀井俊輝, 基盤研究(A), 新材料 MgB₂ と超伝導電流流体解析による新型アンジュレータ精密磁場制御法の確立

全炳俊, 基盤研究(A), 直線偏光ガンマ線のデルブリュック散乱 (分担金)

クラビオット ジョルディ, 若手研究, Comparative studies of culturally-based characterisation of energy

services

2. Others

大垣英明, 国立大学改革強化推進補助金, ICT を利用したハイブリッド型による国内外フィールドワーク・実習教材の開発

大垣英明, 東京大学, 「先端レーザーイノベーション拠点「次世代アト秒レーザー光源と先端計測技術の開発」部門」「自由電子レーザーで駆動する高繰り返しアト秒光源のための基礎基盤技術の研究」

大垣英明, 科学技術振興機構, サトウキビ収穫廃棄物の統合バイオリファイナリー

大垣英明, 科学技術振興機構, 日 A S E A N 科学技術イノベーション共同研究拠点ー持続可能開発研究の推進ー

大垣英明, 研究拠点形成事業 (B), アジア新興国産天然資源を由来とする機能性物質創生のための高度分析研究拠点の形成

大垣英明, 日本中性子光学 (株), 加速器用計測装置の開発・評価

大垣英明, 日立造船 (株), 電子線エミッタの高性能化に関する研究

クラビオット ジョルディ, (公財) 平和中島財団, 東南アジアの非電化農村コミュニティにおける電化による性差別改善に関する研究

Publications

O. Sato, K. Yoshida, H. Zen, K. Hachiya, T. Goto, T. Sagawa, H. Ohgaki, Two-photon selective excitation of phonon-mode in diamond using mid-infrared free-electron laser, Physics Letters A, 384, 10, 126223, 2020

Y. Ikemoto, H. Zen, HgCdTe Detector Saturation Using Infrared Free Electron Laser and Infrared Synchrotron Radiation, Infrared Physics & Technology, 106, 103268, 2020

S. Kashiwagi, H. Saito, F. Hinode, Y. Ishizuki, K. Kanomata, S. Miura, N. Morita, T. Muto, I. Nagasawa, K. Nanbu, K. Shibata, K. Takahashi, K. Terada, H. Yamada, H. Hama, H. Zen, A. Irizawa, Demonstration of Variable Polarized Coherent Terahertz Source, Infrared Physics & Technology, 106, 103274, 2020

T. Kawasaki, T. Sakai, H. Zen, Y. Sumitomo, K. Nogami, K. Hayakawa, T. Yaji, T. Ohta, K. Tsukiyama, Y. Hayakawa, Cellulose Degradation by Infrared Free Electron Laser, Energy & Fuels, 34, 7, 9064-9068, 2020

S. Kosai, J. Cravioto, Resilience of standalone hybrid renewable energy systems: The role of storage capacity, Energy, 196, 117133, 2020

K. Fujimori, M. Kitaura, Y. Taira, M. Fujimoto, H. Zen, S. Watanabe, K. Kamada, Y. Okano, M. Katoh, M. Hosaka, J. Yamazaki, T. Hirade, Y. Kobayashi, A. Ohnishi, Visualizing cation vacancies in Ce:Gd₃Al₂Ga₃O₁₂ scintillators by gamma-ray-induced positron annihilation lifetime spectroscopy, Applied Physics Express, 13, 085505, 2020

H. Zen, H. Ohgaki, R. Hajima, High-extraction-efficiency operation of a midinfrared free electron laser enabled by dynamic cavity desynchronization, Physical Review Accelerators and Beams, 23, 7, 070701, 2020

K. Ali, H. Ohgaki, H. Zen, T. Kii, T. Hayakawa, T. Shizuma, H. Toyokawa, Y. Taira, V. Iancu, G. Turturica, C.A. Ur, M. Fujimoto, M. Katoh, Selective Isotope CT Imaging Based on Nuclear Resonance Fluorescence Transmission Method, IEEE Transactions on Nuclear Science, 67, 8, 1976-1984, 2020

H. Zen, H. Ohgaki, R. Hajima, Record high extraction efficiency of free electron laser oscillator, Applied Physics Express, 13, 10, 102007, 2020

T. Kawasaki, H. Zen, K. Ozaki, H. Yamada, K. Wakamatsu, S. Ito, Application of mid-infrared free electron laser for structural analysis of biological materials, Journal of Synchrotron Radiation, 28, 1, 28, 35, 2021

V. Vai, L. Bun, H. Ohgaki, Integrated Battery Energy Storage into an Optimal Low Voltage Distribution System with PV Production for an Urban Village, International Journal on Advanced Science, Engineering and Information Technology, 10, 6, 2458-2464, 2021

T. Shizuma, F. Minato, M. Omer, T. Hayakawa, H. Ohgaki, S. Miyamoto, Low-lying electric and magnetic dipole strengths in Pb-207, Physical Review C, 103, 2, 024309, 2021

R. Hajima, R. Nagai, K. Kawase, H. Ohgaki, H. Zen, Y. Hayakawa, T. Sakai, Y. Sumitomo, M. Shimada, T. Miyajima, Application of infrared FEL oscillators for producing isolated attosecond X-ray pulses via high-harmonic generation in rare gases, Proceedings of the 39th International Free-Electron Laser Conference,

FEL 2019, 272-275, 2020

N. Sei, H. Ogawa, K. Hayakawa, Y. Hayakawa, K. Nogami, T. Sakai, Y. Sumitomo, T. Tanaka, H. Ohgaki, H. Zen, Coherent edge radiation sources in Linac-based infrared free-electron laser facilities, Proceedings of the 29th Linear Accelerator Conference, LINAC 2018, 154-156, 2020

T. Lhendup, S. Lhendup, H. Ohgaki, Analysis of Heating and Cooling Energy Demand of School Buildings, Proceedings of the 7th International Conference on Advances in Energy Research, 685-694, 2020

H. Ohgaki, T. Kii, H. Zen, How Can a Small-Scale Accelerator Facility Survive? Case Study of the Institute of Advanced Energy, Kyoto University, Proceedings of the 16th Annual Meeting of Particle Accelerator Society of Japan, WEOHP01, 2020

Y. Tanaka, M. Hashida, C. Hosokawa, H. Zen, T. Nagashima, N. Ozaki, S. Inoue, S. Sakabe, Mid-infrared free electron laser induced periodic surface structures on semiconductors, SPIE Digital Library, 11673, 116730U, 2021

R. Hajima, R. Nagai, K. Kawase, H. Ohgaki, H. Zen, Y. Hayakawa, T. Sakai, Y. Sumitomo, M. Shimada, T. Miyajima, Research and development of attosecond VUV and X-ray sources driven by mid-infrared FEL oscillators, EUVXRAY 2020, EF1A.4, 2020

J. Cravioto, H. Ohgaki, H.S. Che, C. Tan, S. Kobayashi, H. Toe, B. Long, E. Oudaya, N.A. Rahim, H. Farzeneh, The Effects of Rural Electrification on Quality of Life: A Southeast Asian Perspective, Energies, 13, 10, 2410, 2020

Presentations

柏木茂, 齊藤寛峻, 寺田健人, 石附勇人, 鹿又健, 柴田晃太郎, 高橋健, 長澤育郎, 南部健一, 日出富士雄, 三浦禎雄, 武藤俊哉, 山田悠樹, 山本大喜, 濱広幸, 全炳俊, 入澤明典, コヒーレント THz アンジュレータ放射の偏光スイッチング, 第 17 回加速器学会年会, オンライン開催, 2020.9.3

全炳俊, 大垣英明, 羽島良一, 長マクロパルス光陰極運転による京都大学中赤外自由電子レーザの高性能化, 第 17 回加速器学会年会, オンライン開催, 2020.9.3

坂上和之, 大垣英明, 大塚誠也, 小柴裕也, 全炳俊, 蓼沼優一, 鷲尾方一, エネルギー変調によって圧縮した電子バンチによるコヒーレントアンジュレー

タ放射, 第 17 回加速器学会年会, オンライン開催, 2020.9.3

全炳俊, 紀井俊輝, 大垣英明, 京都大学自由電子レーザー施設の現状, 第 17 回加速器学会年会, オンライン開催, 2020.9.3

小林進二, 永岡賢一, 長崎百伸, 徳原圭一, 大垣英明, 紀井俊輝, 全炳俊, 岡田浩之, 村田駿介, 大島慎介, 門信一郎, 南貴司, 木島滋, 水内亨, ヘリオトロン型磁場配位における非共鳴マイクロ波を利用した確率的静電加速, 日本物理学会 2020 年秋季大会, オンライン開催, 2020.9.9

早川岳人, 川瀬啓悟, 静間俊行, 羽島良一, ジェームズコーガ, 全炳俊, 紀井俊輝, 大垣英明, 藤本将輝, 加藤政博, レーザーコンプトン散乱 γ 線によるデルブリュック散乱の計測 II, 日本物理学会 2020 年秋季大会, オンライン開催, 2020.9.14

M. Kitaura, H. Zen, Photocarrier dynamics of environmentally-friendly semiconductor Mg₂Si crystal studied by IR pump-probe experiments, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

T. Kawasaki, H. Zen, Development of hyper-efficient degradation method of biomass-related compounds by using mid-infrared free electron laser, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

S. Kashiwagi, H. Saito, H. Zen, High-speed polarization switching using superradiant THz undulator radiation, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

K. Hachiya, R. Akasegawa, K. Yoshida, H. Zen, T. Saggawa, H. Ohgaki, Mode-selective phonon excitation in semiconductors of energy functionality with mid-infrared free-electron laser, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

K. Sakaue, Y. Koshiba, Y. Tadenuma, S. Otsuka, H. Zen, H. Ohgaki, Development of a high peak power and quasi-monochromatic compact THz laser and its applications, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

V. Vai, C. Chhith, S. Eng, C. Hel, O. Eth, L. Bun, H. Ohgaki, Improvement of the Small-scale Biogas Plant for a Household in a Rural Village, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

N. Sei, H. Zen, H. Ohgaki, Observation of temporal evolution of coherent edge radiation during free-electron laser oscillations, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

K. Fukami, Y. Maeda, H. Zen, Electrochemical surface finishing of SiC electrode by controlling the lattice defects: Comparison in the effect of defect formation between DuET and FEL, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

M. Hashida, Y. Tanaka, C. Hosokawa, H. Zen, T. Nagashima, N. Ozaki, S. Inoue, S. Sakabe, Study of periodic nanostructures on semiconductors produced by midinfrared free electron lasers, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

Nasrudin Abd Rahim, Hang Seng Che, Chia Kwang Tan, H. Ohgaki, J. Cravioto Caballero, Study of the suitability of different types of battery for rural electrification and its impact to the quality of life of the communities, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

K. Kawase, R. Hajima, H. Zen, Study for electron-hole plasma on semiconductor surface at midinfrared region, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

J. Fujioka, S. Hoshino, H. Zen, K. Tsukiyama, Processing of organic-inorganic hybrid materials by infrared free electron laser, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

N. Ozaki, D. Kamibayashi, H. Zen, M. Hashida, Characterization of crystalline structure on LIPSS surface induced by intense mid-infrared laser light, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

F. Shishikura, H. Zen, Y. Hayakawa, T. Sakai, Y. Sumitomo, T. Kii, H. Ohgaki, Analysis of electroretinograms from the crayfish's compound eyes stimulated by mid-infrared of KU-FEL, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

S. Kurosawa, H. Zen, K. Fushimi, H. Ohgaki, Study on emission process of scintillation material using the one electron beam and Dark Matter Search with a neutron source, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

T. Kono, T. Sakae, H. Okada, Y. Hayakawa, T. Sakai, H. Zen, T. Kii, H. Ohgaki, Carbon dioxide gas fixation by laser irradiation response to calculus forming bacteria,

The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

L. Seniorita, S.M. Dumlaio, K.K.K. Murthy, C. Qu, J. Cravioto, H. Ohgaki, A Framework for Understanding the Influence of Gender Roles on Appliance Purchasing Behavior of Urban Middle Class in Developing Nations, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

K. Ali, S. Mostafa, Z. Zhang, T. Sagawa, Japan's post-Fukushima, 2011 and Future Energy Landscape, The 11th International Symposium of Advanced Energy Science, Online, 2020.9.15

H. Ohgaki, Present Status and Future Perspective in KU-FEL, Symposium on Exploring Broadband Energy Science 2020, Uji campus, 2020.9.16

J. Cravioto, H. Ohgaki, Electrification in South East Asia: Agendas on the social dimensions, データサイエンスで切り拓く総合地域研究ユニット (DASU) 2020 年度第 1 回研究会, 対面およびオンライン, 2020.9.25

K. Ali, H. Zen, H. Ohgaki, T. Kii, T. Hayakawa, T. Shimazuma, H. Toyokawa, M. Katoh, M. Fujimoto, Y. Taira, 3-D Isotope-selective CT Imaging based on Nuclear Resonance Fluorescence Transmission Method, UVSOR Symposium 2020, Online, 2020.10.26

全炳俊, 中村栄研, 林憲志, 田中清尚, BL5B における光エネルギー変動とその原因調査(2), UVSOR Symposium 2020, オンライン開催, 2020.10.26

藤森公佑, 北浦守, 平義隆, 藤本将輝, 全炳俊, 平出哲也, 鎌田圭, 渡邊真太, 大西彰正, ガンマ線誘起陽電子消滅寿命分光で解き明かす Ce:Gd₃Al₂Ga₃O₁₂ 結晶の空孔型欠陥, UVSOR Symposium 2020, オンライン開催, 2020.10.26

H. Ohgaki, H.S. Che, J. Cravioto, S. Kobayashi, H. Toe, B. Long, E.O. Daya, V. Vannak, C. Kwang T., Nasrudin A. Rahim, H. Farzeneh, Rural electrification and QoL: Lessons from Southeast Asia, The 3rd International Conference on Smart City Innovation (ICSCI), The 13th AUN/SEED-Net Regional Conference on Energy Engineering (RCEnE), The 3rd International Conference on Dwelling Form (iDwell), Online, 2020.10.28

V. Vai, L. Bun, H. Ohgaki, Integrated Battery Energy Storage into an Optimal Low Voltage Distribution System with PV Production for an Urban Village, The 3rd International Conference on Smart City Innovation (ICSCI), The 13th AUN/SEED-Net Regional Conference on Energy Engineering (RCEnE), The 3rd Inter-

national Conference on Dwelling Form (iDwell), Online, 2020.10.28

K. Ali, H. Ohgaki, H. Zen, T. Kii, T. Hayakawa, T. Shimazuma, H. Toyokawa, Y. Taira, M. Fujimoto, M. Katoh, Experimental Study on 3-D Isotope-Selective CT Imaging Based on Nuclear Resonance Fluorescence Transmission Method, 2020 IEEE Nuclear Science Symposium and Metical Imaging Conference, Online, 2020.11.5

H. Zen, H. Ohgaki, R. Hajima, Upgrade of mid-infrared free electron laser at Kyoto University by long macro-pulse photocathode operation of the existing RF gun, IRMMW-THz2020, Online, 2020.11.10

Y. Oshima, T. Naganawa, H. Ohgaki, H. Zen, T. Kii, Synchronously pumped terahertz parametric oscillator driven by amplified picosecond mode-locked laser, IRMMW-THz2020, Online, 2020.11.12

R. Hajima, R. Nagai, K. Kawase, H. Ohgaki, H. Zen, Y. Hayakawa, T. Sakai, Y. Sumitomo, M. Shimada, T. Miyajima, Research and Development of Attosecond VUV and X-ray Sources Driven by Mid-Infrared FEL Oscillator, OSA High-brightness sources and ligh-driven interactions congress, Online, 2020.11.20

J. Cravioto, D.I. Avila-Ortega, Los servicios de energía en el diseño de políticas de acceso a la energía, Coloquio de Pobreza Energética y Cambio Climático en la Región Transfronteriza de México y Estados Unidos, Online, 2020.11.23

M. Kitaura, K. Fujimori, Y. Taira, M. Fujimoto, H. Zen, K. Kamada, T. Hirade, A. Ohnishi, Vacancy-type defects in Gd₃Al₂Ga₃O₁₂:Ce crystals revealed by gamma-ray induced positron annihilation lifetime spectroscopy, 20th International Conference on Defects in Insulating Materials (ICDIM 2020), Online, 2020.11.27

L. Seniorita, S.M. Dumlaio, K.K.K. Murthy, C. Qu, J. Cravioto, H. Ohgaki, Study on the Influence of Gender Roles on Appliance Purchasing Behavior of Urban Middle Class in Developing Nations, Zhejiang - Kyoto - Ajou Joint Symposium on Energy Science, Online, 2020.12.1

K. Ali, H. Zen, H. Ohgaki, T. Kii, T. Hayakawa, T. Shimazuma, H. Toyokawa, M. Katoh, M. Fujimoto, Y. Taira, Three Dimensional Tomographic Isotope Imaging of ²⁰⁸Pb by Nuclear Resonance Fluorescence, Zhejiang - Kyoto - Ajou Joint Symposium on Energy Science, Online, 2020.12.1

R. Akasegawa, O. Sato, K. Yoshida, H. Zen, K. Hachiya,

T. Goto, T. Sagawa, H. Ohgaki, Selective excitation of infrared inactive lattice vibrational mode by mid-infrared free electron laser, Zhejiang - Kyoto - Ajou Joint Symposium on Energy Science, Online, 2020.12.1

K. Ali, NON-DESTRUCTIVE INSPECTION OF ENRICHED ISOTOPE (PB-208) USING NUCLEAR RESONANCE FLUORESCENCE WITH LASER COMPTON SCATTERING, The 3rd International Conference on Radiation and Emission in Materials, Online, 2020.12.17

H. Zen, CURRENT STATUS AND PERSPECTIVES OF KU-FEL, USER FACILITY OF MID-INFRARED FREE ELECTRON LASER AND THZ COHERENT UNDULATOR RADIATION, The 3rd International Conference on Radiation and Emission in Materials, Online, 2020.12.18

H. Zen, KU-FEL, a user facility of MIR-FEL and THz-CUR at Kyoto University, SLRI seminar on THz/IR instrumentation and applications on 21 December 2020, Online, 2020.12.21

全炳俊, 大垣英明, 羽島良一, KU-FEL における共振器型自由電子レーザーの世界最高引き出し効率達成, 第 34 回日本放射光学会年会放射光科学合同シンポジウム, オンライン開催, 2021.1.10

J. Cravioto, Electrification and QoL effects in South East Asia, 膳所高等学校 S S H サイエンスプロジェクト 2020 年第 5 回研究発表会, 膳所高校, 2021.1.23

H. Ohgaki, Introduction of the Japan-ASEAN Science, Technology and Innovation Platform, Workshop on ASEAN Biomass Conversion Technologies, Online, 2021.1.28

J. Cravioto, H. Ohgaki, Innovations and challenges in the use of hard data in Energy-Related research from Social Science and humanities, Data-Oriented Approaches to the Social Sciences and Humanities, 対面およびオンライン, 2021.2.12

Y. Tanaka, M. Hashida, C. Hosokawa, H. Zen, T. Nagashima, N. Ozaki, S. Inoue, S. Sakabe, Mid-infrared free electron laser induced periodic surface structures on semiconductors, Photonics West 2021 Digital Forum, Online, 2021.3.6-11

K. Ali, 3D Imaging of Pb-208 via Nuclear Resonance Fluorescence and computed tomography, 日本原子力学会関西支部若手研究発表会, Online, 2021.3.10

全炳俊, 中赤外自由電子レーザーの性能向上に関する

研究, 日本物理学会第 76 回年次大会, オンライン開催, 2021.3.13

田中陽平, 細川誓, 橋田昌樹, 全炳俊, 長島健, 尾崎憲雅, 井上峻介, 中赤外自由電子レーザー照射により誘起される微細周期構造形成過程のその場観測, 日本物理学会第 76 回年次大会, オンライン開催, 2021.3.15

K. Ali, H. Ohgaki, H. Zen, T. Kii, T. Hayakawa, T. Shizuma, H. Toyokawa, M. Katoh, M. Fujimoto, Y. Taira, Three Dimensional Isotope-Selective Tomographic Imaging for 208Pb distribution based on Nuclear Resonance Fluorescence, 日本原子力学会 2021 春の年会, Online, 2021.3.18

宍倉文夫, 全炳俊, 早川建, 小松崎良将, 早川恭史, 野上杏子, 境武志, 住友洋介, 高橋由美子, 田中俊成, 紀井俊輝, 大垣英明, FEL 光刺激によるアメリカザリガニ複眼の反応, 第 27 回 FEL と High Power Radiation 研究会, オンライン開催, 2021.3.22

全炳俊, 大垣英明, 羽島良一, 京都大学中赤外自由電子レーザーのマイクロパルス形状再構成, 第 27 回 FEL と High Power Radiation 研究会, オンライン開催, 2021.3.23

H. Ohgaki, Introduction to JASTIP Program Phase II, Mahidol-Kyoto On-site Laboratory Workshop on Chemical Engineering on "Nanocarbon Materials for Sustainable Production and Storage of Green Fuels and Platform Chemicals", Online, 2021.3.24